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SHORT COMMUNICATION

Notes on the natural history of the Stump-tailed Porcupine, *Coendou rufescens* (Rodentia, Erethizontidae), in Colombia

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Abstract

Porcupines of the genus *Coendou* are among the least studied mammals in the Neotropics. The Stump-tailed Porcupine, *Coendou rufescens*, is distributed in the Andean region from Colombia and south to Bolivia. Despite its wide distribution, nothing is known about its natural history, besides observation of banana consumption in captivity. Here we present new observations on the feeding habits, diurnal activity, and the use of the tail for support during feeding obtained by means of collaborative (citizen) science. We also comment on its locomotion on land and in trees. We observed five diurnal events of *C. rufescens* feeding on infructescences of trumpet tree (*Cecropia angustifolia* Trécul). During the feeding activities, the Stump-tailed Porcupine used the tail for stability and support. These are the first observations of such behavior in the wild for this species and suggest a more diurnal activity for this species which belongs to a group of rodents traditionally considered to be predominantly nocturnal.

Keywords
Andes, citizen science, diet, diurnal activity, movements, prehensile tail

Introduction

Porcupines of the genus *Coendou* are represented by 16 neotropical species found from Mexico to Uruguay (Voss 2015; Barthelmess 2016). The major species richness is concentrated in Brazil and Colombia with up to 10 and 6 species respectively (Voss 2015; Ramírez-Chaves et al. 2016; Menezes et al. 2020). Although several recent studies have addressed the diversity of *Coendou* throughout its distribution (Leite et al. 2011; Voss 2015; Barthelmess 2016), the natural history for most of the species is practically unknown (Voss 2015). One of the reasons for the lack of knowledge about the natural history of the species is the difficulty in observing the species of *Coendou* due to their nocturnal habits (Barthelmess 2016).

In particular, the Stump-tailed Porcupine, *Coendou rufescens* (Gray, 1865), is an Andean species distributed in Colombia, south to Ecuador, Peru, and northern Bolivia (Acosta et al. 2018; Narváez-Romero et al. 2018). In Colombia, *C. rufescens* is the most common species in the Andean region of the country (Ramírez-Chaves et al. 2016), where it has been registered in 11 departments in the three mountain Cordilleras (Voss 2011). This species is easy to identify due to its reddish dorsal coloration, very short tail (~ 50% of the head-body length) and the body in adults and subadults completely covered by quills (Voss 2011). Despite being considered a common species, observations about its natural history are restricted to reports of leaf feeding from unidentified plants (Voss 2015) and bananas (*Musa* sp.) in Ecuador (Orcés and Albuja 2004; Voss 2015). The short tail of this species compared to other species such as *C. prehensilis*, in particular the fact that it is much longer than the head-body length, has led to suggestions that the Stump-tailed Porcupine tail is not prehensile (Gray 1865; Trouessart 1920; Ellerman 1940; Patzelt 1978; Emmons and Feer 1990; Nowak 1999). In contrast, other authors (Alberico et al. 1999; Voss 2011) have debated this idea based on the presence of a naked, calloused patch of skin on the dorsal surface of the tail, which has been identified in other species of the genus with prehensile tail (Voss 2011).

The increase in recent years of participative science (citizen science) is challenging the traditional view of academic production, in which there is a separation between professionals who do science, and the non-expert public that is seen as the consumer of knowledge and technologies (Strasser et al. 2018). In this way, citizen science empowers citizens to recognize that their contributions can be valuable for the development of scientific knowledge (Kenyon et al. 2020). Digital platforms such as iNaturalist and eBird, community biodiversity monitoring exercises, and open talks to the community on scientific discoveries, are some examples of opportunities for the exchange of knowledge that are flourishing in Colombia today. This also applies to our contribution, which resulted from the collaboration between a non-expert citizen (the second author: CRR) who joined a virtual space

for dissemination about porcupines in Colombia and announced sightings of the Stump-tailed Porcupine. The information about this poorly studied species was then processed by the senior author along with his academic collaborators. Considering the scarce information on the natural history of *C. rufescens*, we present recent observations on its diet in the wild, the use of the prehensile tail as support during feeding, and comment on its locomotion on land and in the trees.

Methods

We documented diurnal activity, feeding events, use of the tail, and locomotion on land and in trees of the Stump-tailed Porcupine *Coendou rufescens* in the Andes of Colombia based on videos from two different localities of the Central Cordillera of Colombia. The videos were obtained thanks to collaborative science. The identification of the individuals was based on the presence of a reddish coloration, bicolored and tricolored spines in the posterior region of the body, and a short tail, smaller than the head and body length (Voss 2015). The feeding behaviors and use of tail were documented in the northern part of the distribution in the Department of Antioquia, Municipality of Medellín, San Antonio de Prado, "Vereda" La Florida (06.174908, -75.668429; 2,180 m a.s.l.). The locomotion in land was documented at the Department of Cauca, Municipality of Silvia, "Vereda" Usenda (02.615779, -76.415555; 2,520 m a.s.l.), around ca. 430 km south of the first locality. In Antioquia, the behaviors were recorded by one of us (CRR) during May–July 2020, in a secondary sub-Andean forest covered by trees between 4 to 15 m high, and dominated by trees over 10 m, and the presence of pioneer species of the first stages of succession such as *Croton magdalenensis* Müll.Arg, *Hedyosmum bonplandianum* Kunth, *Miconia theaezans* Cogn, *Sida* sp., *Montanoa* sp., *Cecropia peltata* L, *Palicourea* sp., and *Saurauia ursina* Triana & Planch, among others. In Cauca, the records were obtained by the anthropologist Mayra Cruz on 4 February 2020 on a road located near open areas in a sub-Andean forest. To identify the plant species consumed by *C. rufescens*, plant photographs were compared with the guidelines provided by Berg et al. (2005), considering diagnostic characters such as presence and type of trichilium, number of the lamina lobes, number of veins in the free portion of the central lobe, absence of stinging hairs, depth of incisions of the lamina, number of catkins (aments) in the female inflorescences and the size of the spathe.

Results

An adult female individual (Fig. 1A) was observed five times during different dates in May, June, and July at "Vereda" La Florida, on the 25th and 31st of May, on the 27th and 29th of June and on the 7th of July 2020. During all observations, the individual was feeding on the infructescence of trumpet tree *Cecropia angustifolia* Trécul (Fig. 1B), directly from the plant, or taking the infructescence and eating holding them in the hand (Fig. 1C). The tree has an approximate height of 16 m and

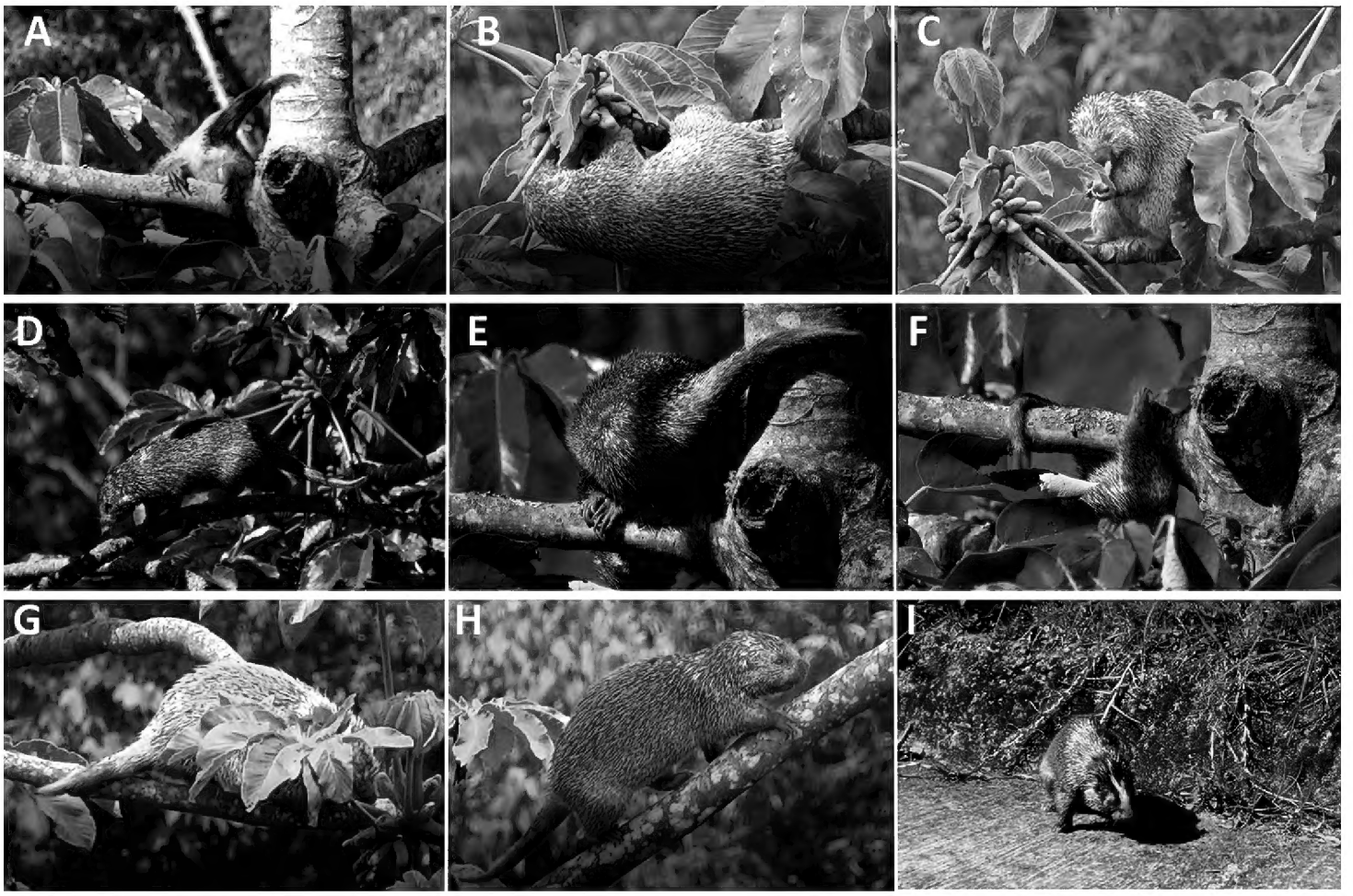

Figure 1. Observations of the Stump-tailed Porcupine *Coendou rufescens* in the Andes of Colombia. A Details of the female genitalia B, C Feeding on *Cecropia angustifolia* D Active walk searching for food E–G Use of the tail for holding on to the tree H Details of the position of the tree during walking I Detail of walking activity on a paved road.

the individual actively moves around the branches of the tree to consume the fruit (Fig. 1D). In each event, the consumption lasted approximately 20 minutes. All observations occurred during the morning and afternoon (Table 1). As we observed in the recordings, the tail was used as a support during feeding activities (Fig. 1E–G). Even if the individual does not use the tail to support the totality of the suspended body, it is clear that the tail is used to hold on to the tree and maintain balance while descending or during standing in the tree (Fig. 1F). The tail did not touch the branches of the tree while the animal was walking (Fig. 1H). A previous observation of an individual was done six months before in the same locality also during daytime but was not recorded. Other mammal species documented in the tree are of the Red-tailed Squirrel (*Syntheosciurus granatensis*) and the Pucheran's Squirrel (*Leptosciurus pucheranii*).

At the "Vereda" Usenda (Table 1), an individual of unknown sex was filmed crossing a paved road during daytime (10 h 02 min.) on 4 February 2020. The individual was actively walking, exhibiting good performance on the ground (Fig. 2) and was not afraid of people (Fig. 1I). During walking, the individual was moving its tail to both sides depending on the hindfoot that was moving, and the tail was not touching the ground. Only when the individual stopped, the tail touched the ground (Fig. 1H, I).

Table 1. Observations on natural history of the Stump-tailed Porcupine *Coendou rufescens* in three localities of Colombia. Localities are 1: "Vereda" La Florida, Department of Antioquia, 2: "Vereda" Usenda, Department of Cauca, and 3. Barrio La Sultana (05.060337, -75.473223, 2,149 m a.s.l), Manizales, Department of Caldas, Colombia. User: Cristina Romero Ríos (CRR).

Date and hour	Locality	Observations	User	Evidence (Photographs, videos)
25 May 2020 8 h 40 min.	1	*Cecropia* consumption and active search for food in the tree	iNaturalist: cristinaromerorios YouTube: CRR	https://colombia.inaturalist.org/observations/47293571 https://youtu.be/pmtS1IMYzb0
31 May 2020 8 h 30 min.	1	*Cecropia* consumption and active search for food in the tree	iNaturalist: cristinaromerorios YouTube: CRR	https://colombia.inaturalist.org/observations/49790083 https://youtu.be/Acf82Zx1wIM
27 June 2020 16 h 30 min.	1	*Cecropia* consumption and active search for food in the tree	iNaturalist: cristinaromerorios	https://colombia.inaturalist.org/observations/51285488
29 June 20: 9 h 40 min.	1	*Cecropia* consumption and active search for food in the tree	iNaturalist: cristinaromerorios	https://colombia.inaturalist.org/observations/52433164
07 July 2020 11 h 40 min.	1	*Cecropia* consumption and active search for food in the tree	iNaturalist: cristinaromerorios	https://colombia.inaturalist.org/observations/52434710
4 February 2020 10 h 03 min.	2	Walking on a paved road		Fig. 1I
12 June 2020	3	Walking on a paved road		https://laciudadpositiva.com/video-que-lindo-el-puercoespin-que-paseo-por-la-sultana-en-manizales/

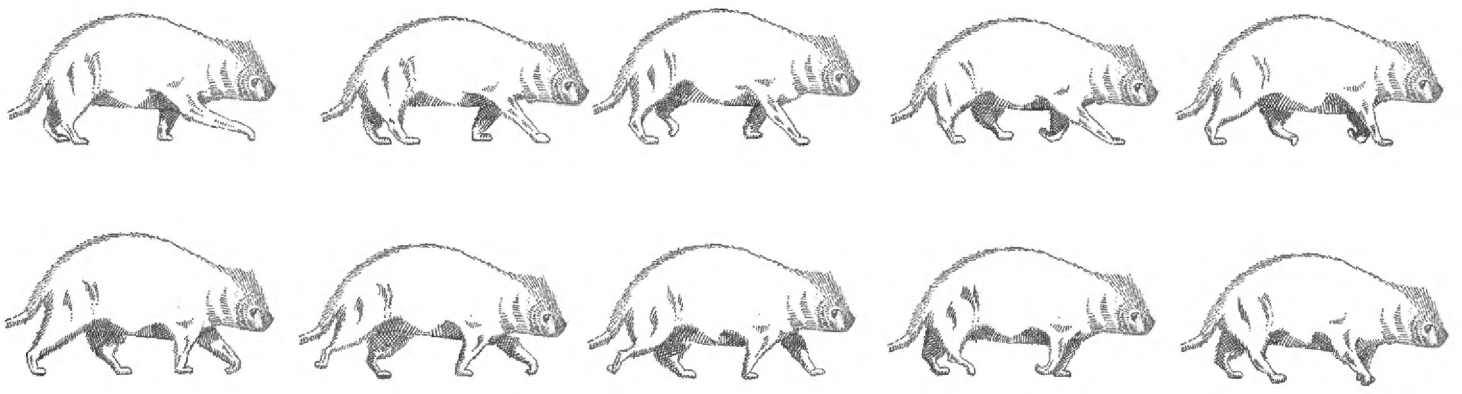

Figure 2. The locomotion in the ground of the Stump-tailed Porcupine *Coendou rufescens* in the Central Andes of Colombia.

Discussion

Our observations based on citizen science provide novel information on the natural history of the Stump-tailed Porcupine *Coendou rufescens* in Colombia. Apparently, the diurnal activity was not an isolated event, as it was observed in two different localities in the country, and contrasts with previous nocturnal activity patterns observed in other porcupine species (Gregory et al. 2015; Barthelmess 2016). However, *C. rufescens* is also nocturnal, as it has been shown in recent

videos in the media in urban areas of the Municipality of Manizales, Department of Colombia (Ciudad Positiva 2020; Table 1). Furthermore, the active locomotion in the ground and trees was also expected. Previous reports for other Caviomorph rodents (Osbahr and Azumendi 2009), indicated that the performance both on land and on a tree can vary in the width of the step and its speed due to the close relationship between locomotion and the natural history of organisms. The fact that *C. rufescens* crosses roads and is regularly detected in urban areas explains the elevated rates of mortality by road kills documented in Colombia (Delgado Vélez 2014).

We also gleaned new information regarding the natural history of this poorly studied species, including new food items composing the diet of *C. rufescens*. The new findings were not unexpected given that parts of *Cecropia* trees are consumed by several mammal species (Fleming and Williams 1990). The distribution of *Cecropia angustifolia* includes all the countries in which *C. rufescens* is found (Franco-Rosselli and Berg 1997), but not restricted to the Andes (Berg et al. 2005), therefore, it might be consumed along the porcupine range. Previous records of the diet of this species were taken in Ecuador where it was reported feeding off leaves from unidentified plants (Voss 2015) and bananas (Orcés and Albuja 2004; Voss 2015). The use of the tail to support the body during activities on trees also provides evidence that, as in other long-tailed porcupines, it is prehensile, although probably the tail cannot hold the whole body suspended.

Finally, the use of citizen science has provided valuable information on the study of rare mammal species in Colombia (Gerstner et al. 2018; de Roux et al. 2019); however, this is one of the first attempts to document information on a relatively common species that lacks information about its natural history. Contributions by citizens to science, although not new, have increased markedly in our times (Bonney et al. 2014). This should provide an incentive to create more spaces and strategies to encourage the participation of non-specialists and also give empowerment in order to cultivate this symbiosis: citizens learn about and engage with biodiversity, while the scientific community is favored by a bigger reach of data while gaining greater public support for its scientific work. As suggested by other authors (e.g., de Freitas et al. 2013; Gregory et al. 2015; Ramírez-Chaves et al. 2020), the use of less conventional sources of information, is providing important ecological and natural history information on these poorly known porcupine species.

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